



WOMEN IN PHYSICS TODAY

By Dorothy W. Weeks

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TODAY'S occupational pattern of women in physics contrasts significantly with that of yesterday. The causes of these changes are of necessity conjectural—early marriage, the rapid growth of physics with the need for more physicists, the changing attitudes of public opinion, a lessening of prejudices regarding women in physics, and the public awareness that persons trained in science and engineering are a much needed national resource being among the many such causes. Previous uncorrelated studies made by the author, and her awareness of the rather unique problems women must meet if they are to establish themselves as physicists, form the basis for this article. No exhaustive nor comprehensive study of women in physics today is contemplated here. Specific examples are given only to illustrate changes.

It may perhaps prove enlightening to compare the numbers of women who were listed as fellows of the American Physical Society in 1941 and in 1958. In 1941, twenty-one of the 907 fellows (2.3%) were women; in 1958, thirty of the 1624 fellows (1.8%) were women. Twelve of the 1941 fellows taught in the liberal arts colleges for women, but in 1958 there were only four. In 1958, seven of the women fellows had retired, nine were in universities, four in national laboratories, three in industry, and one (Charlotte Moore Sitterly) in the federal government. Mrs. Sitterly is at the National Bureau of Standards where, prior to World War I, no woman, not even a woman secretary, was employed. Early this year she received the Exceptional Service Award from the US Department of Commerce for her research in spectroscopy and astrophysics.

While women physicists have been, and still are, few in number, they have received Guggenheim, National Research Council, and National Science Foundation fellowships. Two have received the Achievement Award of the American Association of University Women—Katharine B. Blodgett of the General Electric Company in 1945 and Chien-Shung Wu of Columbia University in 1959. Only recently have women presided at

meetings of the American Physical Society. Since January 1, 1958, at least three women have done so—Dr. Wu, Fay Ajzenberg-Selove of Haverford College, and Katharine Way of the National Research Council. Women physicists have always given contributed papers at meetings of the Society, but since January 1, 1958, at least five women have given invited papers—Elizabeth J. Allin of the University of Toronto, Janice Button of the University of California, Joan Freeman of Harwell, Phyllis S. Freier of the University of Minnesota, and Gertrude Scharff-Goldhaber of Brookhaven.

Contributions of three women physicists are listed by Wehr and Richards¹ in their "Chronology of the Atomic View of Nature": in 1939, Lise Meitner with Otto R. Frisch proposed nuclear splitting to explain Hahn's results on the disintegration of uranium by neutrons, and predicted the release of an enormous amount of energy in fission; in 1949, Maria Goeppert Mayer of the University of Chicago developed the shell theory of the nucleus; and, in 1956, Dr. Wu with collaborators performed the first clear experimental demonstration of a violation of the law of parity conservation.

In 1958, Rita Sagalyn of the US Air Force Geophysics Laboratories was awarded a Gunther Loesser Memorial Award for outstanding contribution to research in geophysics.

At least seven of these women are married, and three have children. They represent universities, men's colleges, national laboratories, and agencies of the federal government, including the Department of Defense. Their fields of research include high-energy physics, nuclear structure, satellites, and meteorology. They received their undergraduate education from colleges for women, coeducational liberal arts colleges, and universities. These women illustrate significant changes in the position of women in physics.

ABOUT five years ago the author made a study of those students in the United States who received a degree in physics during the five-year period

Degrees Granted in Physics (1949-1953)²

		1949	1950	1951	1952	1953	Total	%
PhD or ScD	Men	259	353	435	476	472	1995	98.3
	Women	7	5	8	9	6	35	1.7
MA or MS	Men	798	888	934	851	686	4157	95.8
	Women	43	34	39	35	33	184	4.2
BA or BS	Men	2645	3287	2671	2141	1921	12 665	95.4
	Women	183	127	117	106	84	617	4.6
BA or BS* (10 schools)	Men	400	275	304	224	257	1460	98.4
	Women	3	5	4	7	5	24	1.6
MIT**	Men	46	61	52	66	56	281	98.6
	Women				1	3	4	1.4

* Degrees granted at ten coeducational universities and technical institutions selected because of the large number of PhD's granted in this five-year period.

** One of the group of ten selected schools, used as an example.

1948-49 through 1952-53. The accompanying table² shows the results.

A more detailed analysis was made of the institutions graduating the 617 women who majored in physics. During the same five-year period, five colleges for women (with an approximate total yearly enrollment of 7300) graduated 72 of these women, whereas the group of ten selected institutions having an approximate total yearly enrollment of 33 000 women graduated only twenty-four women majors in physics, and the twenty-two small liberal arts coeducational colleges listed in the study by Knapp and Greenbaum,³ with an approximate total yearly enrollment of 9000 women, graduated twenty-one women majors in physics.

This study shows that the liberal arts colleges for women were not only graduating more women physics majors during that five-year period, but also a much greater number proportionally. If the universities had produced women physics majors in the same proportion they would have graduated 325 in the five-year period.

During the same time span, the number of physics majors (both men and women) steadily decreased. Today this trend is being reversed. The number of physics majors at Wellesley College, for example, is increasing, as is the number of students taking two years of physics. Although more physics degrees were awarded in the ten-year period from 1935 to 1944 than in the five years from 1949 to 1953, the number receiving doctorates increased from 1412 in the ten-year period to 2030 in the five-year period. Forty of the 1412 and thirty-five of the 2030 were women.

The results of this five-year study are consistent with those obtained from a study of the women in physics listed in the 7th edition of *American Men of Science*. Sixty-six women physicists educated in the United States are included, of whom thirty-one graduated from liberal arts colleges for women and fourteen were fellows of the American Physical Society. In that listing the names of two of the women physicists (Dr. Blodgett and Hertha Sponer of Duke University) were starred to indicate their selection as part of the group

of one thousand leading scientists thus singled out in the 1944 volume.

Although no study has been made of the institutions currently graduating women in physics, there seems to be every indication that the liberal arts colleges for women will continue to produce physicists, but that a larger percentage of women physics majors will be graduated from the coeducational colleges, universities, and technical schools than has been true in the past.

For example, a study made about five years ago by the Women's Association of the Massachusetts Institute of Technology⁴ reports the number of women who have received a degree in physics at MIT. According to that study, only nineteen women with a major in physics had graduated from MIT through 1955; fifteen had received the master's degree and ten had gone on to receive the doctorate in physics. The number of women receiving degrees in physics at MIT during the five-year period 1949-53 is given in the table. For the five-year period 1957-61, MIT expects to have graduated twelve women physics majors—two each in the past three years, one this year, and five in 1961. Today, five of MIT's 200 graduate students in physics are women. Also indicative of changes are the facts that students of weather radar at MIT are taught by a woman (Pauline Morrow Austin) and that MIT has recently announced the anonymous gift of \$1.5 million for an on-campus dormitory for women.

Bibliography

1. R. M. Wehr and J. A. Richards, Jr., *Physics of the Atom* (Addison Wesley Publishing Co., Inc., Reading, Mass., 1960).
2. US Office of Education Circulars, Nos. 262, 282, 333, 360, and 380.
3. R. H. Knapp and J. J. Greenbaum, *The Younger American Scholar: His Collegiate Origins* (University of Chicago Press, 1953).
4. Registration Committee, MIT Women's Association, "The MIT Coed—Then and Now", *Technology Review* 58, No. 2 (December 1955).